2nd Annual Symposium
Toward a Global Earth Observation System of Systems
Future National Operational Environmental Satellites

Calibration and Verification Activities for NPP/NPOESS VIIRS

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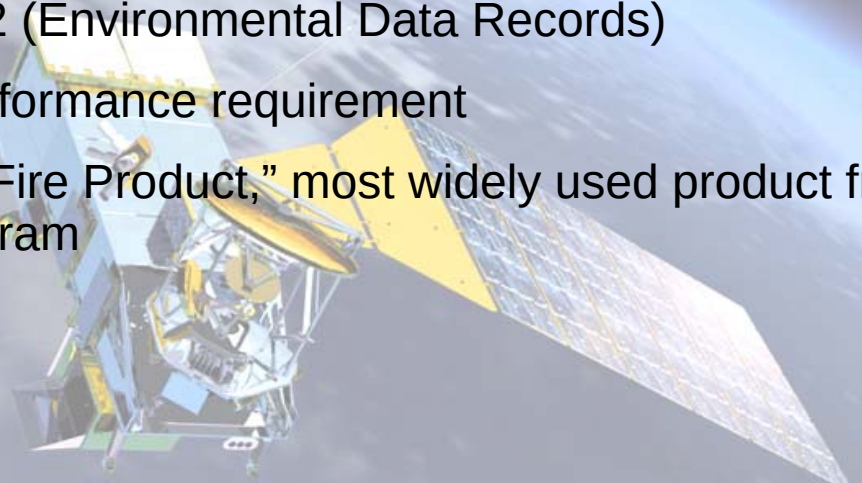
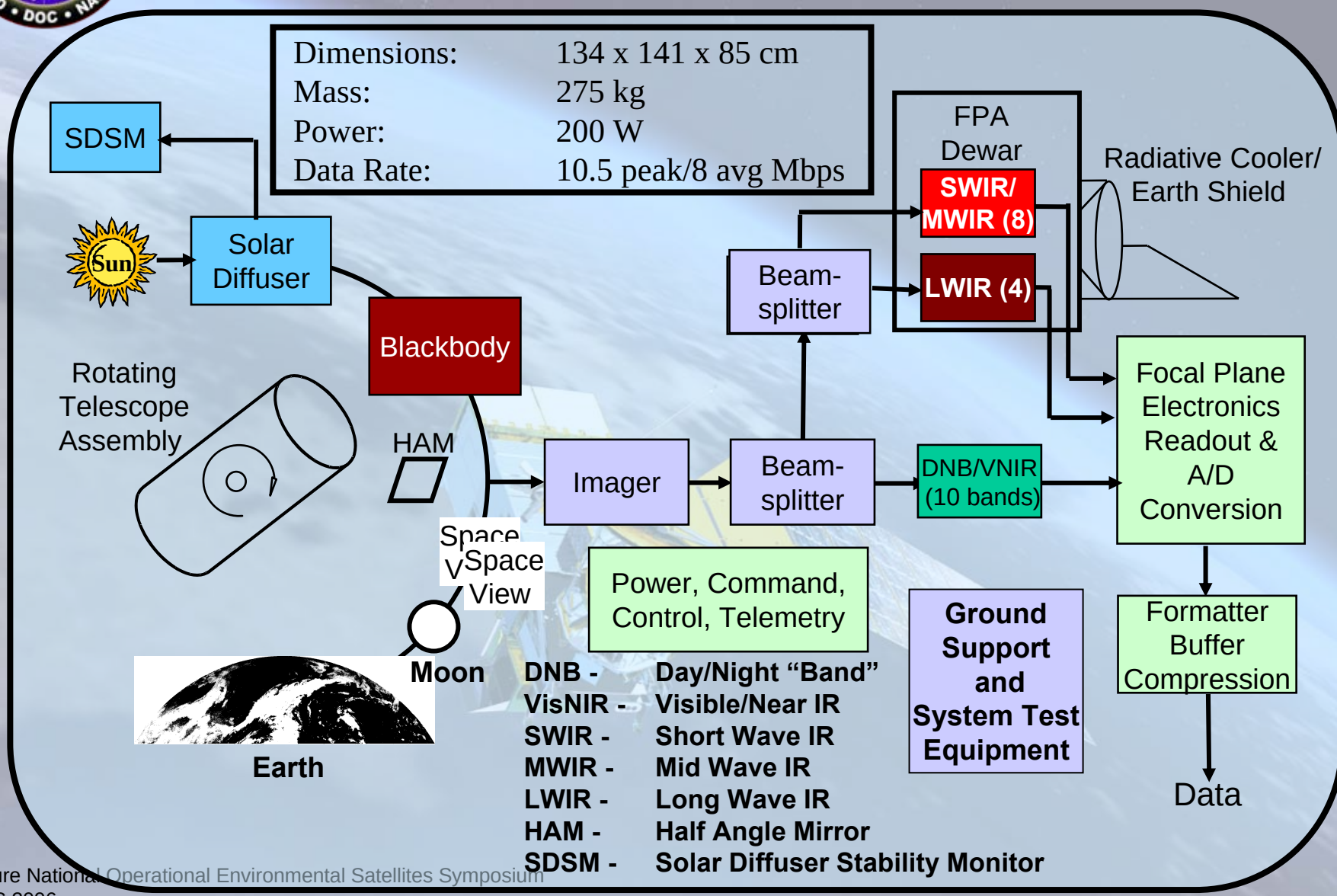
Introduction (VIIRS)

- **Visible Infrared Imager/Radiometer Suite**
  - First flight on NPOESS Preparatory Project
  - Key NPOESS sensor
    - 25 Level 2 (Environmental Data Records)
    - 2 Key Performance requirement
    - Basis of “Fire Product,” most widely used product from EOS program



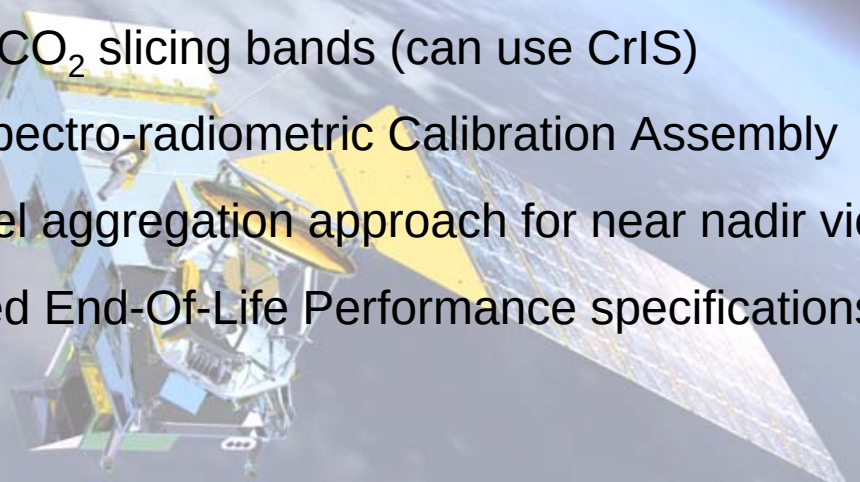
Photons to Digital Data: VIIRS Architecture Stable Since PDR

Dimensions:	134 x 141 x 85 cm
Mass:	275 kg
Power:	200 W
Data Rate:	10.5 peak/8 avg Mbps



MODIS → VIIRS

- **Changes from MODIS requirements:**
  - Added imaging capability
  - Converted nearby bands to dual gain bands
  - Removed CO_2 slicing bands (can use CrIS)
  - Deleted Spectro-radiometric Calibration Assembly
  - Added pixel aggregation approach for near nadir views
  - Guaranteed End-Of-Life Performance specifications



Primary Design Differences

- **Added Imaging Capability – RTA (4 MIRROR ROTATING TELESCOPE ASSEMBLY plus HAM (HALF-ANGLE MIRROR) replaces *single scan mirror***
- **At Nadir, detector FOV 250m square from *250, 500 and 1000m square***
- **Incorporated 8 dual gain bands**
- **Solar Differ screen fixed, adding Earthshine shade to repair effect found on MODIS**

Reflective Sensor Solar Bands Calibration Requirements

Requirement Title	Requirement Value
Calibration uncertainty of the reflective, given a uniform scene of typical spectral radiance	Less than 2 %
Reflectance band calibration in terminator orbit	Less than5 %
Calibrated output of all channels within a band (sigma = 1)	Match the mean within NeDL
VIS/NIR/SWIR response uncertainty	Characterized within 3%

Reflected Solar Bands Calibration Requirements

		Single Gain		Dual Gain			
				High Gain		Low Gain	
Center Wavelength (nm)	Gain Type	Ltyp	SNR	Ltyp	SNR	Ltyp	SNR
412	Dual			44.9	352	155	316
445	Dual			40	380	146	409
488	Dual			32	416	123	414
555	Dual			21	362	90	315
672	Dual			10	242	68	360
746	Single	9.6	199				
865	Dual			6.4	215	33.4	340
1240	Single	5.4	74				
1378	Single	6	83				
1610	Single	7.3	342				
2250	Single	0.12	10				
(I) 640	Single	22	119				
(I) 865	Single	25	150				
(I) 1610	Single	7.3	6				

Sensor Thermal Emissive Bands Calibration Requirements

	Scene Temperature				
Center Wavelength (μm)	190K	230 K	270 K	310 K	340 K
3.7	N.A.	7.0%	7.0%	0.7%	0.7%
4.05	N.A.	5.7%	0.7%	0.7%	0.7%
8.55	12.3%	2.4%	0.6%	0.4%	0.5%
10.763	2.1%	0.6%	0.4%	0.4%	0.4%
12.013	1.6%	0.6%	0.4%	0.4%	0.4%

Thermal Emissive Bands Calibration Requirements

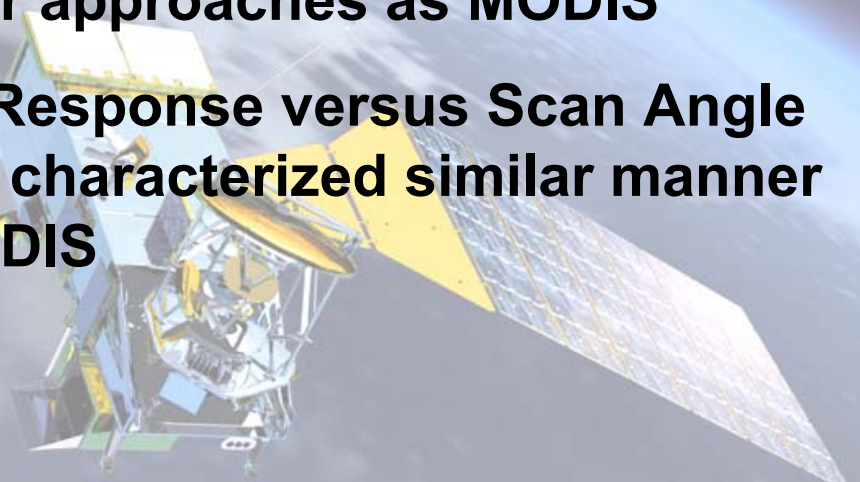
		Single Gain		Dual Gain			
				High Gain		Low Gain	
Center Wavelength (nm)	Gain Type	Ttyp	NEdT	Ttyp	NEdT	Ttyp	NEdT
3700	Single	270	0.396				
4050	Dual			300	0.107	380	0.423
8550	Single	270	0.091				
10763	Single	300	0.07				
12013	Single	300	0.072				
3740	Single	270	2.5				
11450	Single	210	1.5				

Testing Approaches for Reflected Solar Bands (RSB)

- Spectral radiance calibration with similar sources as MODIS
- Polarization characterization with similar source as MODIS
- Spectral calibration with similar approaches as MODIS

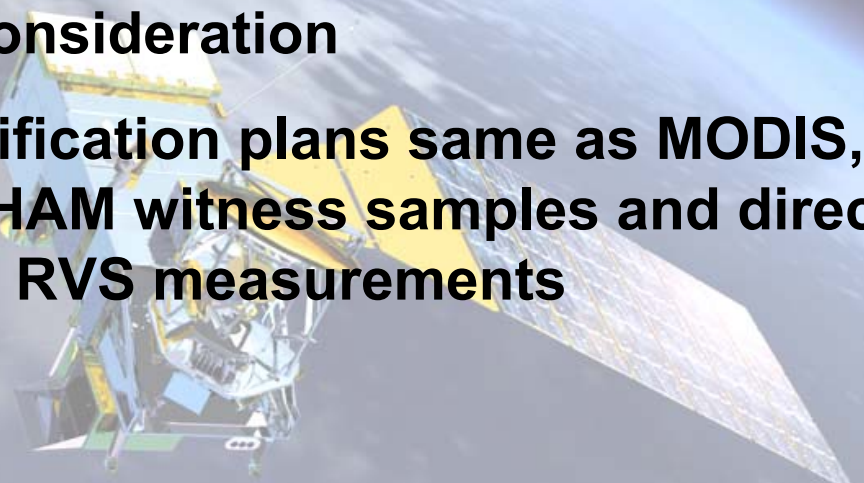
Testing Approaches for Thermal Emissive Bands (TEB)

- **Spectral radiance calibration with similar sources as MODIS**
- **Spectral calibration with essentially similar approaches as MODIS**
- **HAM Response versus Scan Angle (RVS) characterized similar manner to MODIS**



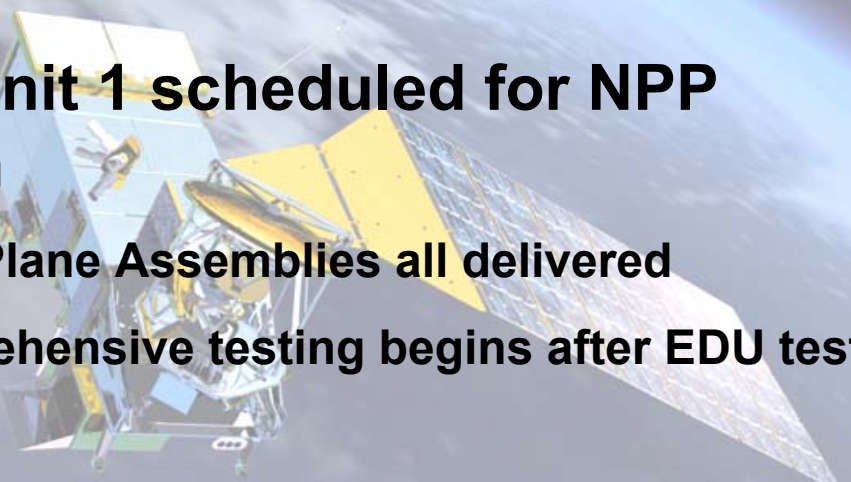
Selected Approaches for Verification

- **RSB verification still under investigation. Ozone column, sounder experience suggests End_to_end (E2E) test coupled with Solar Diffuser BRF. E2E test still under consideration**
- **TEB verification plans same as MODIS, RVS of HAM witness samples and direct ambient RVS measurements**



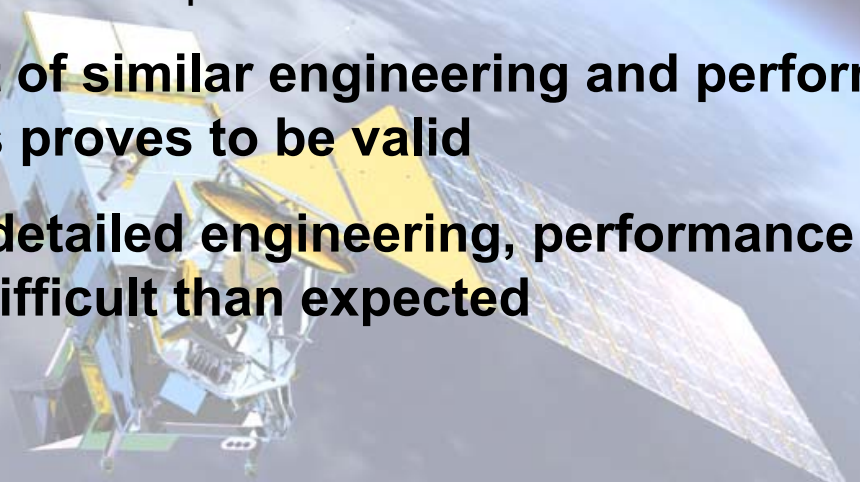
Status

- **Engineering Development Unit:**
  - **Nearing completion**
  - **Comprehensive Ambient Testing Complete**
- **Flight Unit 1 scheduled for NPP mission**
  - **Focal Plane Assemblies all delivered**
  - **Comprehensive testing begins after EDU tests**



Conclusions

- **Program design for VIIRS based on strong MODIS heritage**
  - MODIS research program
  - VIIRS operational program, guaranteed performance, end of life performance specifications
- **Development of similar engineering and performance requirements proves to be valid**
- **Accomplish detailed engineering, performance for VIIRS more difficult than expected**



National Polar-orbiting Operational Environmental Satellite System